ASK BO

DATACOM

The Burning Question
Part 2

Our datatcom writer here completes a two-part undertaking—tackling the difference between various cable materials and their fire ratings.

BY D.A. "BO" CONRAD, RCDD

READ PART ONE FIRST!

To read this two-part series in sequence, find Part One (a 4-page PDF) here:

www.rexelusa.com

Click on the *POWER OUTLET* MAGAZINE button then Past Issues, then V8N1.

Find the Datacom ("Ask Bo") article, and click to download.

In Part One of this article, we covered the controversy over cable fire ratings and took a tour of the cable types. We'll continue from there.

Downside

The downside is cost and the by-product of irritant gases when polymers burn. The same Category 6 cable can range from:

- $95 to $135 for CMR;
- $195 to $295 for CMP; and
- $550 to $650 for LC.

Therefore, another common cable manufacturing technique to pass the UL 910 test is to "stretch" the cost of using PFP by utilizing PVC or HDPE (in lieu of PFP) around one pair of conductor insulation. This is known as the "3 x 1"

TABLE ONE

NEC Chapter 8 Cable Fire-Ratings

Fire Resistance Level	Flame Test Requirements	800 Article	800 Article	820 Article	770 Article	770 Article	CSA Standard
Plenum	UL-910 NFPA 262 (Steiner Tunnel)	MPP	CMP	CATVP	OFNP	OFCP	FT 6
(LSZH) Riser	UL-1666 (Vertical Shaft)	MPR	CMR	CATVR	OFNR	OFCR	FT 4
General Purpose	UL-1581 (Vertical Tray)	MPG	CMG	CATV	OFN	OFC	FT 4
Residential	UL-1581 UW-1 (Vertical Tray)		CMX				

KEY

Type MP	Multi Purpose
Type CM	Communications Cables
Type CATV	Community Antenna Television & Radio Distribution Cables
Type OFN	Optical Fiber Non-conductive
Type OFC	Optical Fiber Conductive
Ending in:	
P	Plenum rating
R	Riser rating
G	General purpose rating
X	Residential rating
LSZH	Low Smoke Zero Halogen

ratio and so forth.

LC-rated cable is near 100% PFP around the jacketing, the conductor insulation, and the spacer.

CMP jacketing is typically comprised of FRPVC/HDPE. Only the insulation and spacer is PFP (sometimes with one conductor pair using PVC/HDPE) to pass the UL 910 burn test.

TABLE TWO

Cable Component	PVC/E	LSZH/PE	PVC/PFP	PVC/PVP Alternate
Conductor	50%	50%	48%	49%
Jacket	33%	33%	23%	18%
Insulation	15%	15%	21%	19%
Spacer	3%	3%	7%	14%
Mass (kg/km)	42.0	42.0	43.1	42.4

CMR jacketing is usually HDPE/PP and the conductors and spacer FRPVC/HDPE to pass the UL 1666 burn test—less stringent than the UL 910.

Problems When It Burns

When polymers burn, they emit dioxins (which are very toxic). For example, pure PVC is very rigid (gutters, water pipes, house siding, etc.) and needs plasticizers for flexibility and stabilizers to reduce the "char" effect. But it is still flammable; it gives off dense smoke.

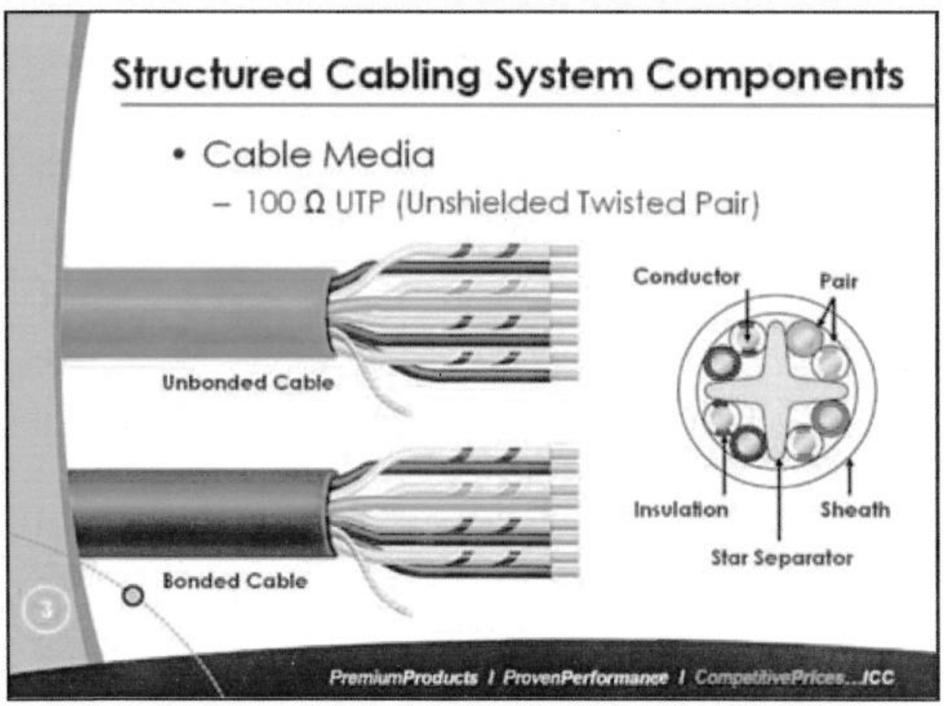
Additionally, some contend that there is a long-term problem as well—with lead leaking out as the product ages.

You need to be a chemist to really understand the intricacies in establishing the testing and the analysis from recent burn studies of these polymers; toxicity submicron analysis, use of cone calorimeters, gas FTIR analyzers and gas spectrometers for measuring; 0_2. CO, CO_2, HCl, HF, and COF.

Need to cut to the conclusion? Irritant gases from these cables would have a substantial effect on people trying to evacuate from a burning building—both on their lungs (from toxic fumes) and by reducing visibility.

But which one buys the most time and is less to propagate?

You also have to take into consideration the CO emitted into a burning building from other burning materials likely to be found in such a structure—furniture, carpet, equipment, ceiling tiles, the building itself, etc.



Electrical vs. Fire Performance

Other polyolefins—such as HDPE, FRPE, and PP—have inherently outstanding electrical performance—but offer few (if any) fire-performance characteristics.

Chemical studies have shown polyethylene (PE) in its raw stage has the near fire potential as gasoline. Qualified as a "hydrocarbon" or made from oil, PE can quickly ignite, generate intensively hot, fast burning flames, and propagate while giving off very smoky, noxious fumes.

TABLE THREE

Material	Plenum-Grade PVC Jacket wt%	LSZH Jacket wt%
Polyvinyl Chloride (PVC)	43%	
Ethylvinyl Acetate (EVA)		60%
Aluminum Trihydrate (ATH)	30.4%	30%
Phthalate Plasticizer	8.7%	7%
Ca/Zn Stabilizer	3%	3%
Kemguard HPSS	4.4%	
Brominated Flame Retardant	8.7%	
Antimony Oxide	1.3%	

In other words: Such a cable would act like a quick burning fuse.

To improve the fire-ratings of these other non-PFP materials, attempts are made to add such things as bromated or chlorinated flame retardants, hydrate fillers, and oxide fillers all to reduce the fire-load. Table Three exhibits just one example of additive materials used for PVC and LSZH to improve their fire-ratings.

Often, these additives can compromise a cable's electrical and/or mechanical properties. As a result, the cables have to be balanced to fully meet both the UL 910 Steiner Tunnel burn test and the Category (6) performance rating.

OTHER CONSIDERATIONS

Another consideration in selecting cable for use in a building is the growing concern (of customers, contractors, and others) to see to the reduction of greenhouse gas emissions.

Look for studies that compare the costs of producing, ultimate energy consumption, and recycling of PFP, CMP, or LC cables to that of manufacturing steel conduit. These studies will, as well, include the by-products associated with production of polymers of PVC, PP, HDPE, LSPE, and LSZH.

There are also the Reduction of Hazardous Substances (RoHS) ratings (from Europe). These, if they apply in your case, will require the elimination of heavy metals (lead) and other materials.

—D. Conrad

Put Them Inside Conduit—Or Not?

According to the 2005 NEC, communication cables in plenum environments that do not meet minimal UL 910 plenum requirements are required to be installed inside rigid conduit. Here we are talking about the use of Electromagnetic Tubing (EMT), Intermediate Metallic Conduit (IMC), or Rigid Metallic Conduit (RMC galvanize water pipe—not gas pipe).

Additionally, the 2005 NEC states that the cables in conduit do not need to have even minimal fire-ratings including LSZH, CMR, CMG, or CMX.

Result: We now see the Steel Tubing Institute (STI or www.steelconduit.org) promoting CMR/CM/LSZH communication cables inside EMT for plenum-rated environments.

STI's claim is this: It is safer with less toxicity, more economical, and allows for easier moves and changes to install EMT in a home-run fashion—as compared with the use of unprotected LC or CMP cables.

As of this writing, NFPA testing has concluded that CMR, CM, LSZH, or even non-fire-rated cables in conduit do not have to be fire tested together to achieve a plenum-rating. It is *assumed* that the cables inside will not ignite, burn, or spread smoke.

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Again, HDPE, FRPE, and PP offer outstanding electrical performance. Therefore, use of a lower-fire-rated cable in EMT conduit—providing the higher fire protection barrier—would be the preferred fire-safety electrical performance technique.

Are Costs An Issue?

You might end up taking costs of labor and material into consideration.

Conduit installation is performed by electricians (not datacom techs)—and electricians have a higher pay scale. Each drop adds up substantially—3x to 4x more than unprotected cable. Stub-ups alone are typically $30 each.

Bottom line: Savings coming from the use of LC or CMP cables could very well be offset by the cost of "piping" the conduit infrastructure. Of course, future moves and changes are reduced only if you can utilize the existing conduit.

Remember, the NFPA-70 NEC code is what the Authority Having Jurisdiction (AHJ)—fire marshals, electrical inspectors, and building inspectors—will use. In most municipalities, the NEC is the law (it is adopted whole or as locally modified).

What's more, there are ongoing (and aggressive) cabling industry marketing campaigns for both cabling-chemical and conduit solutions.

The Weakest Point

Assuming that you've read Part One and the information above, perhaps you now have come closer to fully understanding the controversy in specifying "unprotected" (not-in-conduit) Perflouropolymer CMP or LC cables vs. "protected" CMR/CM (or even non-rated cables) in conduit for plenum spaces.

Again, this also applies to Optical Fiber Non-Conductive Plenum (OFNP) vs. OFNR (Riser)/OFN and Community Antenna Television and Radio Plenum (CATVP) vs. CATVR (Riser)/CATV cables outside or inside conduit.

Further studies and testing by a few select chemical and wire-and-cable companies are challenging the "single-minimum" test techniques—which are given in NFPA 90A, NFPA 255, and other standards.

Weakest point has shown to be the unions (or couplers) that "puddle" at temperatures as low as 450°F. This temperature is significantly below that of many fires... which can reach 900°F to 1,000°F.

Subsequently, this puddling creates an air gap—leading to the burning of cables inside. Additionally, this "pipeline" of burning gases may lead to a "chimney" or "blow" torch effect at the conduit ends.

And different fire-ratings and fill ratios have varying, significant results.

Where The Community Stands

UL has not yet drawn any conclusion based upon the data or the products currently being tested; the respected testing group remains on a "fact finding" mission as of this writing.

Thus, CMP is still the highest plenum-rated approved cable. The other approved alternative is lower or even non-rated cables in conduit. Either solution is sufficient to having both fire and electrical "equivalent functional performance."

Optimally, the solution (or compromise)—would be to install LC or CMP fire-rated cables inside EMT conduit. *This would definitely be harder to pull!*

Alternatively, one metal manufacturer strongly recommends open cable tray supported by threaded rod. *A recommendation:* Be cautious of the dramatically increased costs over unprotected cables running through "J"-hooks or equivalent! The "burning question" could lead to the incineration of your checkbook!

Conrad is owner of Crossbow Communications (www.crossbowcom.com).